genus *Synallactes*, represented by two species, has hitherto been recorded from southern Africa. The material at hand contains two further species that belong in the genera *Mesothuria* and *Pseudostichopus*.

Genus *Mesothuria* Ludwig, 1894

Mesites Ludwig, 1893: 79. Type species *M. multipes* Ludwig (*nomen nudum*).
Mesothuria Ludwig, 1894: 31. Fisher, 1907: 679. Deichmann, 1930: 91.
Zygothuria Perrier, 1898: 126.
Allantis Hérouard, 1902: 18.

Diagnosis (partly after Fisher 1907: 679)

Cylindrical to subcylindrical synallactids with a slightly flattened ventral surface. Mouth and anus usually terminal. Brim or anal furrow absent. Tentacles 12–20. Pedicels on ventrolateral ambulacra usually well developed, on mid-ventral ambulacrum small or absent, small, scattered and papilliform dorsally. Gonad in a single tuft. Tables with a circular disc with large perforations and a spire terminating in one or more toothed or smooth apices.

Type species. *Mesothuria multipes* Ludwig, 1894 (by monotypy).

Remarks

The genus *Mesothuria* at present comprises about 25 nominal species of which only *M. parva* (Théel) is here recorded for the first time from southern Africa. This is also the first record of the occurrence of this species from the Western Indian Ocean. *Mesothuria lactea*, described by Heding (1940) from 'off the west coast of South Africa' at 30°34,9′S 6°E, is from too far offshore to be regarded as strictly southern African.

Mesothuria parva (Théel, 1886)

Figs 1, 6A

Holothuria murrayi var. *parva* Théel, 1886: 186, pl. 9 (fig. 2), pl. 16 (figs 4, 5).
Mesothuria parva Fisher, 1907: 686, pl. 71 (fig. 2, 2a–c).

Diagnosis (after Fisher 1907: 686)

Medium-sized, cylindrical species, up to 100 mm long. Colour, in alcohol, yellowish white, greyish brown or purplish black. Pedicels of variable size, scattered all round, largest in ventrolateral ambulacra, few and small in mid-ventral ambulacrum, numerous, scattered and papilliform dorsally. Table disc large, with a large central hole and several marginal holes; spire of three non-diverging pillars with a compact, toothed, often tripartite apex and a single cross bar. Pedicels with small tables, large end plates but no supporting rods.

Previous southern African record

None.

Material examined

SAM–A23434, off Sodwana Bay, R.V. *Meiring Naude*, SM 15, 27°31,5′S 32°45,6′E, 25 May 1975, 280–454 m, beam trawl, 2 specimens.

Description

Lengths 75 mm and 37 mm. Colour, in alcohol, dull greyish brown, darker ventrally. Podia more sparsely distributed mid-ventrally, absent just behind collar. Polian vesicles paired. Body-wall spicules in the form of tables of two distinct sizes. Discs of large tables (Figs 1A, C, 6A) (0,100–0,135 mm) overlapping, marginal holes 6–24; spire (0,078–0,113 mm) of three (occasionally fused) pillars, a single cross bar situated near disc, and a compact, tripartite or irregular apex, occasionally pierced by a minute hole. Smaller tables (Fig. 1B) less common, discs 0,055–0,095 mm, marginal holes 6–18. Anal region with large periproctal plates (Fig. 1D). Pedicels with small tables and large (0,27–0,30 mm) end plates. Tentacles with smooth to spinulated rods, occasionally perforated at extremity (Fig. 1E).

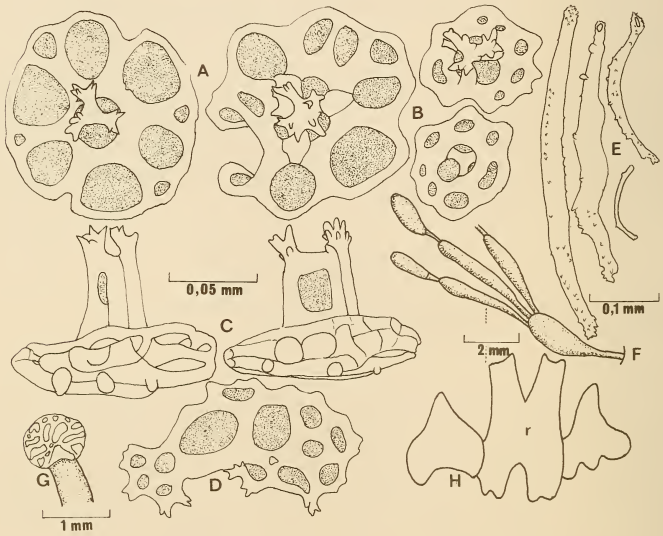

Fig. 1. *Mesothuria parva* (Théel). SAM–A23434. Spicules and other internal structures. A. Large tables from dorsal body wall. B. Small tables from ventral body wall. C. Large table from side. D. Periproctal plate. E. Tentacle rods. F. Gonadal tubule. G. Madreporite. H. Part of calcareous ring. Abbreviation: r—radial plate.

Remarks

The present material differs from that described by both Théel (1886) and Fisher (1907) in the absence of a marked difference in size between the ventrolateral pedicels and those from elsewhere on the body. However, its spicules are identical to those illustrated by the above authors. Tables with perforated apices were also observed by Fisher. According to Théel, the smaller tables are commoner in the body wall, whereas Fisher stated that they are confined to the pedicels. In the present material both small and large tables occur in the body wall but the former are not at all common, whereas the pedicels only contain small tables. Although the maximum size of the table discs (0,135 mm) in the present material corresponds roughly to that of Fisher's material (0,12 mm), the spires are much taller (max. size 0,113 mm) compared to 0,085 mm recorded by him. Unless Fisher recorded the mean, this difference might suggest geographical variation. The mean for the present material is 0,096 mm.

The species is closely related to *M. murrayi* (Théel); Fisher (1907) pointed out that the differences in the calcareous deposits between the two are possibly attributable to the substrate, *M. murrayi* living in softer bottoms than *M. parva*. However, he mentioned that, due to the absence of intermediate forms and the lack of difficulty in separating them, they should be regarded as separate species.

Distribution

Off Sodwana Bay, Natal, 280–454 m. Also recorded from Hawaii, Admiralty Island, and south-east Africa.

Habitat

Globigerina ooze, sand grains and broken shells.

Genus *Pseudostichopus* Théel, 1886

Pseudostichopus Théel, 1886: 169. Fisher, 1907: 691. Heding, 1940: 356.

Diagnosis (after Fisher 1907: 691)

Body form cylindrical, subcylindrical or flattened. Podia of diverse size, usually large in the ventrolateral ambulacra, absent or rudimentary in the odd ambulacrum. Anus situated in a perpendicular furrow at posterior end; anal teeth absent. Body wall usually encrusted with foreign material such as foraminiferans, pteropod shells, other shell fragments, sponge spicules and sand grains.

Type species. *Pseudostichopus mollis* Théel, 1886 (by subsequent designation of Fisher 1907: 691).

Remarks

Heding (1940) referred this genus, together with several others previously occupying isolated positions in the Synallactidae, to the family Gephyrothuridae, diagnosed by Koehler & Vaney (1905) for their monotypic *Gephyrothuria*

alcocki. A similar form from the Eastern Pacific was described as *Himasthlephora glauca* by H. L. Clark (1907). *Gephyrothuria alcocki* was stated to be molpadid-like, whereas *H. glauca*, which possessed a tail-like appendage, was described as a molpadiid. According to Clark, both *H. glauca* and *G. alcocki* may be congeneric, whereas Rowe (pers. comm.) considers that they may even be conspecific. If this is true, *Pseudostichopus* cannot be placed in the Gephyrothuriidae and should therefore, at least tentatively, be transferred back to the Synallactidae.

Pseudostichopus is a fairly large cosmopolitan genus subdivided by Heding (1940) into the subgenera *Pseudostichopus* and *Trachostichopus*, each containing six nominal species. *Pseudostichopus (P.) echinatus*, here described as new and represented in the collection by a single specimen, is the only representative of the genus in southern Africa.

Subgenus *Pseudostichopus* Théel, 1886

Diagnosis (after Heding 1940: 356)

Cylindrical species with no or little distinction between the ventrolateral and other podia. Spicules absent from body wall, including anal region.

Type species. *Pseudostichopus mollis* Théel, 1886 (by original designation of Heding, 1940: 356).

Remarks

This subgenus includes all cylindrical species without body-wall spicules and with little or no distinction between the ventrolateral and other podia. When proposed by Heding (1940), the subgenus contained six nominal and one unnamed species. The single specimen in the SAM collection from off Natal is identical to Heding's unnamed species from off the East African coast. It is here described as *P. (P.) echinatus* sp. nov.

Pseudostichopus (Pseudostichopus) echinatus sp. nov.

Fig. 2

Pseudostichopus (Pseudostichopus) sp. Heding, 1940: 360, text-fig. 16.

Diagnosis

A medium-sized species up to 65 mm long. Body wall encrusted with shells, foraminiferans, sand grains, etc. Tentacles ?17. Podia scattered, only slightly longer in ventrolateral radii. Stone canal rudimentary or absent. Spicules restricted to tentacles, in the form of large (up to 0,3 mm), irregularly knobbed rods. Body wall, podia, respiratory trees and gonad without spicules.

Etymology

The specific name is derived from *echinos* (Greek): sea urchin, with reference to the echinoid appearance of the holotype.

Material examined

Holotype, SAM–A23435, SAM, R.V. *Meiring Naude*, SM 38, off Natal coast, 28°21,9′S 32°34,6′E, 28 May 1975, 775–825 m, beam trawl.

Description

Specimen (Fig. 2A) partially eviscerated, most of alimentary canal lost. Length 55 mm, breadth in mid-body 12 mm. Colour, in alcohol, a uniform pale greyish brown. Body almost cylindrical, dorsal surface arched, ventral less so. Mouth small, ventral. Tentacles white, peltate, about 17, all except three retracted (exact number not determined for fear of damage to holotype). Anus subventral, situated in a conspicuous vertical furrow; no anal papillae. Body wall encrusted with *Globigerina* ooze, shell fragments, coral debris, sand grains and

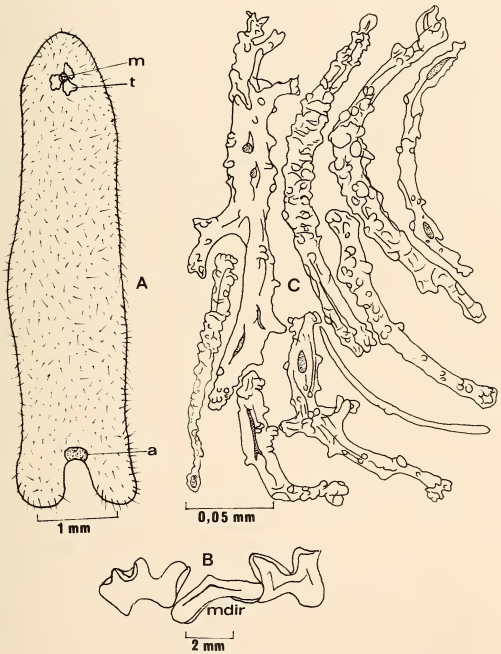

Fig. 2. *Pseudostichopus (P.) echinatus* sp. nov. SAM–A23435. Holotype. A. Entire animal. B. Part of calcareous ring. C. Tentacle rods. Abbreviation: mdir—mid-dorsal interradial plate.

pteropod (*?Creseis*) shells, the latter projecting perpendicularly from surface giving specimen a prickly appearance, not unlike that of heart urchins. Body wall remarkably thin, especially ventrally.

Podia thin, non-retractile, barely visible to unaided eye, scattered but more numerous and slightly longer in the ventrolateral ambulacra, shorter dorsally, few and small in mid-ventral ambulacrum, where they are difficult to distinguish from encrustations; discs small, brownish; end plates and supporting rods absent.

Calcareous ring (Fig. 2B) delicate, radial plates dissimilar, usually squarish, concave posteriorly but either scalloped anteriorly or with a single median notch; interradial plates more uniform, four times as wide as long, with a short anterior triangular median projection and a concave posterior margin. No tentacular or podial ampullae. Polian vesicle single, mid-ventral, sacciform. Stone canal not observed (?rudimentary or absent). Longitudinal muscles thick, unpaired. Respiratory trees short, well branched and with common origin, left tree shorter than right.

Gonad (?testis) attached in anterior third of body, developed as two tufts of unbranched tubules, each constricted serially along entire length. Cloaca wide, suspensors well developed.

Spicules. Spicules (Fig. 2C) confined to tentacles, in the form of numerous slightly curved, often branched rods of varying size (up to 0,3 mm long) and thickness, each ornamented with numerous knobs of varying size and density; rarely rods thin and smooth but occasionally with holes resulting from fusion of once parallel branches.

Remarks

There are no differences between the present specimen and Heding's (1940) *Pseudostichopus (P.)* sp. Their size, form, encrustations, distribution of podia and the presence of identical spicules (confined to the tentacles) indicate that they belong together.

A species that closely resembles *P. (P.) echinatus* is *P. (Trachostichopus) trachus*, originally described by Sluiter (1901) from the West Pacific but also recorded by Mitsukuri (1912), Mortensen (1917), and Heding (1940). According to Heding, both Mitsukuri's and Mortensen's descriptions of *P. (T.) trachus* refer to another species as they do not correspond with that of the type. *Pseudostichopus (P.) echinatus* resembles Sluiter's and Heding's descriptions of *P. (T.) trachus* in the restriction of the spicules to the tentacles but differs in its cylindrical form, absence of thickened flanks, lack of a sharp distinction between the ventral podia, and different form and size of the tentacle spicules. In *P. (T.) trachus* the spicules have fewer knobs, lack perforations and measure 0,13 mm in length, unlike those of *P. (P.) echinatus* which are heavily knobbed, occasionally perforated and have an upper size limit of 0,3 mm.

Heding's *P. (T.) trachus* was taken off the central East African coast at 638–977 m and his *Pseudostichopus (P.)* sp. also came from more or less the same locality at 693 m. Despite this, Heding not only emphasized the

differences between the two species but went so far as to refer them to different subgenera. Therefore it does not seem likely that the two forms are conspecific.

Pseudostichopus (P.) echinatus differs from the six species included in the subgenus *Pseudostichopus* by Heding as follows: the type species *P. (P.) mollis* Théel, 1886, has at least the ventrolateral pedicels arranged in rows and, in addition to the tentacles, has spicules also in the gonad and pedicels; *P. (P.) pustulosus* Sluiter, 1901, also has the ventrolateral pedicels arranged in rows but the stone canal is distinct and the genital tubules branched; *P. (P.) unguiculatus* Ohshima, 1915, has deposits in the tentacles, gonad and pedicels; *P. (P.) lapidus* Hérouard, 1923, has very few pedicels, which are united by some sort of webbing posteriorly; *P. (P.) globigerinae* Hérouard, 1923, has no spicules, whereas *P. (P.) marenzelleri* Hérouard, 1923, has podia apparently arranged in bands and spicules in only the genital tubules.

Distribution

Type locality and East African coast, south of the equator.

Order Elasipodida Théel, 1881

Remarks

This is an exclusively deep-sea order of usually large, often bizarre holothurians with peltate tentacles and no respiratory trees. In an excellent revision of the order, Hansen (1975) assembled the approximately 110 species recognized by him into the suborders Deimatina and Psychropotina. Both suborders are represented in southern Africa by a total of 15 species; however, only the former is present in the collection at hand.

Suborder deimatina Hansen, 1975

Diagnosis (after Hansen 1975: 14)

Spicules perforated plates (or derivatives of these), spatulated crosses, rods or wheels; no primary crosses with arrested development of dichotomous divisions. Papillae usually numerous and large.

Remarks

This suborder comprises elasipodids with numerous, usually large papillae. It includes the families Deimatidae and Laetmogonidae, both with representatives in southern Africa. However, only the former is represented in the present collection.

Family **Deimatidae** Ekman, 1926

Diagnosis (after Hansen 1975: 15)

Spicules varying from perforated plates and spatulated primary crosses, to spatulated, spinous or reduced and deformed bodies; wheels absent. Gonad consisting of few, unbranched, sacciform tubules.

Remarks

This family, characterized by the absence of wheels, includes the genera *Deima*, *Oneirophanta* and *Orphnurgus*, collectively containing eight species. All three genera are represented in southern Africa, the former two each by a single species recorded by Hansen (1975), but not present in the collection here examined. The genus *Orphnurgus*, first recorded from southern Africa by A. M. Clark (1977), is represented by three species, of which two are new.

Genus *Orphnurgus* Théel, 1879

Orphnurgus Théel, 1879: 8; 1882: 82. Hansen, 1975: 38 (synonymy).

Diagnosis (after Hansen 1975, modified herein)

Tentacles 15–20, non-retractile, discs with ramified processes. Circumoral papillae absent. Spicules spatulated crosses and/or rods of greatly varying shape, either spatulate, spindle-shaped, smooth with dichotomous ramifications, or spinous, often a combination of two types.

Type species. *Orphnurgus asper* Théel, 1879 (by monotypy).

Remarks

This genus was erected by Théel (1879) for the West Indian species *O. asper*, characterized by only spinous rods in the body wall. Since then the following eight Indo-West Pacific species, all referable to *Orphnurgus*, have been described: *Orphnurgus glaber* Walsh, 1891 (Koehler & Vaney, 1905): with smooth elongate rods with short, sometimes spinous, terminal ramifications; *Orphnurgus invalidus* Koehler & Vaney, 1905: with mainly spatulate rods; *Orphnurgus insignis* Fisher, 1907: with crosses and dichotomously ramified rods; *Orphnurgus vitreus* Fisher, 1907: with spatulate rods and sometimes spatulate crosses; *Orphnurgus rigidus* Ohshima, 1915: with spatulate rods only; *Orphnurgus bacillus* Cherbonnier & Feral, 1981: with rods with spinulated ends; *Scotodeima protectum* Sluiter, 1901: with spatulate crosses only; and *Amphideima investigatoris* Koehler & Vaney, 1905: with spatulate rods only.

These species were further distinguished by the number and distribution of pedicels and papillae in either single or double rows and by the presence or absence of any transformation of the spicules ventrally.

In his revision, Hansen (1975) recognized only *O. asper*, *O. glaber*, *O. vitreus* and *O. protectus*, and relegated the remaining four species to the synonymy of *O. glaber* because of the 'presence of many intergradations' (Hansen 1975: 40). This action resulted in *O. glaber* being represented by several morphological types showing numerous geographical variations, not only in the spicules but also in the number and distribution of pedicels and papillae.

A study of the present material reveals the presence of *O. insignis* (sensu Fisher 1907) and two further morphological types, also referable to *Orphnurgus*. Of the latter, one is intermediate between *O. asper* and *O. insignis*, having both

O. asper and *O. insignis* type of rods, whereas the other, which has double rows of pedicels and dorsal papillae, is characterized by only *O. asper* type of rods in the dorsal body wall and a mixture of *O. asper* and *O. insignis* type in the ventral body wall. However, all three types show similar transformation of deposits ventrally. Because of these intergradations, the writer was at first inclined to refer all three types to *O. asper* and to relegate *O. glaber* (sensu Hansen) and its synonyms to the synonymy of this species. Such a step would have not only affected the status of *O. glaber* but also of *O. vitreus* and *O. protectus*, characterized by spatulate rods and/or crosses, since spatulate rods are the basic type of deposit in *O. glaber* (sensu Hansen) and spatulate crosses also occur sporadically in some forms of the latter species. Rowe (pers. comm.), who examined my slides, is of the opinion that the three types represent different species and is inclined to consider Hansen's decision as too sweeping. This problem would be further aggravated if all nominal species of *Orphnurgus* and the southern African material are lumped under *O. asper*, which would then assume the status of a superspecies.

Since the southern African forms differ not only in their deposits but also in some other significant features, all three types are here described as distinct species, namely, *O. insignis* Fisher and two others, *O. aspersignis* sp. nov. and *O. natalasper* sp. nov.

KEY TO THE SOUTHERN AFRICAN SPECIES OF *ORPHNURGUS*

1. Pedicels and dorsal papillae in double rows on each side of body; dorsal spicules exclusively short, spinous, often perforated, rods ..... ***Orphnurgus natalasper*** sp. nov.
— Pedicels and dorsal papillae in single rows on each side of body; dorsal spicules either exclusively smooth rods with terminal dichotomous ramifications or accompanied by short, spinous, non-perforated rods 2
2. Dorsal spicules exclusively smooth rods with open, often spiny, dichotomous ramifications; no short spinous rods in integument; papillae elongate, often filiform ..... *Orphnurgus insignis* Fisher, 1907
— Dorsal spicules with short, spinous, non-perforated rods in combination with dichotomously ramified rods; papillae short, stout, often rudimentary ..... ***Orphnurgus aspersignis*** sp. nov.

Orphnurgus aspersignis sp. nov.

Figs 3, 6B

Orphnurgus glaber (non Walsh, 1891) A. M. Clark, 1977: 146.

Diagnosis

A medium-sized species up to about 100 mm long. Tentacles 15–20 with bright yellow discs. Ventrolateral pedicels in single rows of 15–20 on each side, mid-ventral pedicels absent. Ventrolateral papillae 6–10 on each side, usually larger than dorsal papillae, the latter in a single row of 7–20 on each side of mid-

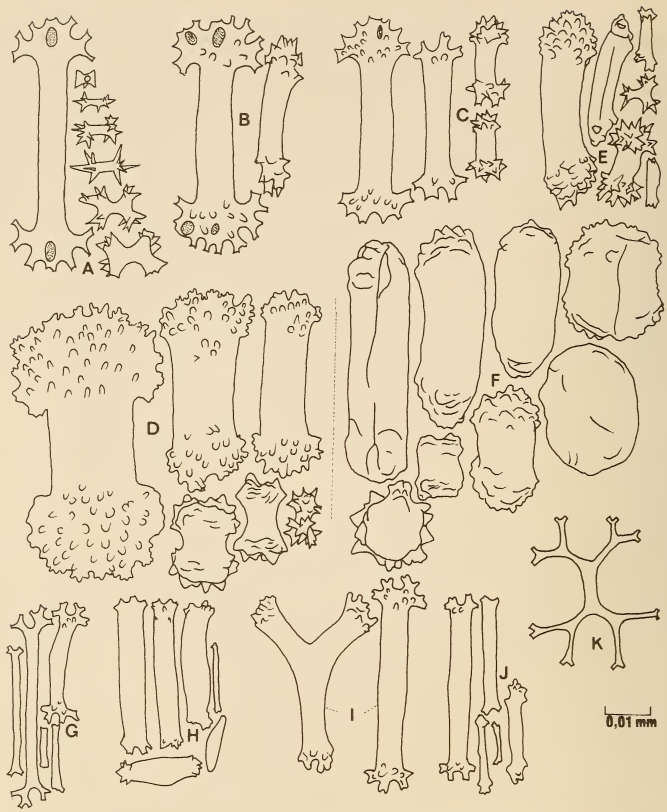

Fig. 3. *Orphnurgus aspersignis* sp. nov. SAM–A23436. Holotype. Spicules. A. Anterodorsal body wall. B. Mid-dorsal body wall. C. Posterodorsal body wall. D. Anteroventral body wall. E. Mid-ventral body wall. F. Posteroventral body wall. G. Papillae rods. H. Pedicel rods. I. Rods from tentacle tips. J. Cross from body wall. All drawn to same scale.

dorsal line; papillae generally short, often stout or rudimentary. Spicules numerous, short, non-perforated, spinous rods and a few elongate smooth rods with open, often spinous, dichotomous ramifications; ventral spicules always sturdier and transformed into dumbbell-shaped, rounded, ellipsoidal or amorphous bodies. Smooth primary crosses with arrested dichotomous divisions occasionally present.

Etymology

The specific name is derived from a combination of *asper* and *insignis* because of the presence of spicules similar to those of *O. asper* Théel and *O. insignis* Fisher.

Previous record

Off Natal coast, 1 000–1 200 m, as *O. glaber* A. M. Clark, 1977.

Material examined

Holotype, SAM–A23436, off Sibaya, Natal, R.V. *Meiring Naude*, SM 72, 27°17,8′S 33°04,5′E, beam trawl, 20 May 1976, 1 050 m. Paratypes, SAM–A23437, same data as holotype, 4 specimens. Paratype, SAM–A23438, off Sodwana Bay, Natal, R.V. *Meiring Naude*, SM 77, 27°31,6′S 32°50′E, heavy dredge, 21 May 1976, 780 m, 1 specimen.

Description

Holotype. Length 90 mm, breadth in mid-body 20 mm. Anterior and posterior ends of more or less equal width, only slightly less than that of mid-body. Colour yellowish white with bright yellow to orange tips to tentacles, pedicels and larger papillae. Form subcylindrical, ventral surface flattened, dorsal somewhat arched. Odd ambulacrum marked by absence of podia but presence of a faint longitudinal line, indicating position of mid-ventral longitudinal muscle. Skin opaque to somewhat translucent, but not as much as in *O. insignis*. Body wall thin and rough to the touch.

Mouth terminal but ventrally directed, collar absent. Tentacles 20, non-retractile, stalks thin, white, discs with contracted ramifications and hence distinctly peltate or subglobose in appearance. Anus terminal but slightly dorsal, anal papillae absent.

Ventrolateral pedicels in single rows, 15 on the left and 18 on the right, conical, non-retractile, projecting horizontally from body, longest anteriorly (8 mm), decreasing in size posteriorly. Ventrolateral papillae 10 on each side, placed in a single row, short (max. length 6 mm), stout, often quite rudimentary, never filiform. Dorsal papillae 16 on the left and 13 on the right, one row in each side of dorsal mid-line, papillae short (max. length 8 mm), often stout or quite rudimentary.

Calcareous ring delicate, poorly calcified. Tentacular ampullae absent. Water ring well developed, proximal ends of radial canals broad. Polian vesicle single, elongate (14 mm), reaching level of gonad, originating from water ring slightly to left of left dorsal radius. Madreporite sieve-like, external, situated between the most anterodorsal papillae. Longitudinal muscles as thin double strands. Gonad in two clusters of small globular sacs of varying size, each cluster resembling a bunch of grapes.

Spicules. Dorsally simple non-perforated short spinous rods (0,06–0,15 mm) of the *O. asper* type but with spines usually developed only at

extremities, and elongate rods (0,29–0,47 mm) of the *O. insignis* type with terminal, often spiny, open dichotomous ramifications (Figs 3A–C, 6B); ventrally sturdier rods (0,20–0,63 mm), transformed into huge dumbbell-shaped, ellipsoidal, rounded or amorphous bodies with spinous extremities, the spines representing pointed ends of otherwise fused ramifications (Figs 3D, F, 6B). Simple primary crosses (0,285 mm long) with arrested dichotomous ramifications also present (Fig. 3K). Pedicels with elongate, slender to stout, smooth rods with short spinous terminal ramifications (Fig. 3H). Papillae with small slender rods with dichotomous, usually non-spinous ramifications (Fig. 3G). Tentacles with rods similar to those of papillae but often with spinous ramifications (Fig. 3J), those of tentacular stalks occasionally Y-shaped and up to 0,45 mm long (Fig. 3I).

Paratypes. Size range 65–95 mm. Colour and body wall as in holotype. Tentacles 15–19 (two specimens each with 15, one with 18, and two each with 19). Ventrolateral pedicels 17–20 on each side (max. length 15 mm). Ventrolateral papillae 6–9 on each side (max. length 10 mm); dorsal papillae always in single rows, 8–16 on each side (max. length 8 mm). Spicules as in holotype.

Remarks

This species is well characterized by the presence of both spinous rods and elongate rods with dichotomous ramifications. The simultaneous presence of both these deposits renders the new species intermediate between the West Atlantic *O. asper* Théel and the Indo-West Pacific *O. insignis* Fisher. No species with a similar combination of spicules has yet been described from other parts of the world. *Orphnurgus aspersignis* is, however, closer to the sympatric *O. insignis* since it shares with it a low number of dorsal papillae arranged in single rows, identical rods with dichotomous ramifications and a similar transformation of the ventral deposits. *Orphnurgus asper*, on the other hand, has a high number of dorsal papillae arranged in double rows, different type of spinous rods, lacks ramified rods and shows no transformation of the deposits.

As in the other species of the genus, the number of tentacles in the new species varies from 15 to 20 and there is no apparent correlation between tentacle number and size of the specimen since the two largest specimens have 15 and 20 tentacles.

No general increase in the number of ventrolateral pedicels is apparent with increase in the size of the specimens, perhaps because the sample size (6 specimens) is too small or the size range of the specimens too narrow (65–95 mm) for any effective analysis. However, such a correlation, with notable exceptions, was reported for *O. insignis* by Fisher (1907) and for *O. glaber* (s.l.) by Hansen (1975).

As in *O. glaber* (s.l.), there is a general increase in the number of both dorsal and ventrolateral papillae with increased size of the specimens, the larger specimens having 10–12 pairs of each type, whereas the smaller ones have

7–8 pairs, with a 75 mm specimen being an exception with 8 pairs of ventrolateral and up to 11 pairs of dorsal papillae.

There is also, in each specimen, a close correlation between the number of ventrolateral and dorsal papillae, with one or two exceptions. Generally a high number of ventrolateral papillae is accompanied by a more or less similar number of dorsal papillae. However, no correlation exists in each specimen between the number of papillae and pedicels.

The short spinous rods are derived from tiny bow-shaped deposits that come to bear a cluster of spines, usually at each of the four extremities or, more exceptionally, all round. As in *O. glaber*, the basic spicules are found dorsally but both the spinous and dichotomously ramified rods become robust posterodorsally. The ventral spicules are always robust but tend to increase in sturdiness posteriorly while becoming progressively deformed. Such transformation is not dependent on age since all specimens, without exception, show similar transformation. The type of transformation, as in *O. glaber* (sensu Hansen), does not involve the extremities of the spicules, as these are nearly always preserved.

A juvenile specimen, referred to *O. glaber* by A. M. Clark (1977), was described as having spicules similar to those of *O. asper* and *O. insignis*. Regrettably this specimen could not be located by the South African Museum in the material returned by Clark. However, judging from the data given by Clark, the specimen in question was part of the present collection and hence *O. glaber* A. M. Clark (*non* Walsh) is here relegated, without doubt, to the synonymy of *O. aspersignis*.

Distribution

Off Natal coast between Richards Bay and Kosi Bay, 780–1 200 m.

Orphnurgus insignis Fisher, 1907

Figs 4, 7A

Orphnurgus insignis Fisher, 1907: 702, pl. 73 (fig. 1), pl. 77 (figs 1–3). Ohshima, 1915: 234; 1916–1919, 3 figs. Cherbonnier & Feral, 1981: 361, fig. 2A, K.
Orphnurgus glaber Hansen, 1975: 39 (*part.*), text-fig. 13 (28–33, 40–45).
non *Orphnurgus glaber* Walsh, 1891. A. M. Clark, 1977: 146 (= *O. aspersignis* sp. nov.).

Diagnosis (from Fisher 1907, modified herein)

Small to medium-sized species, reaching a length of 160 mm. Tentacles 15–20. Ventrolateral pedicels 14–24 on each side in single rows, rarely about 30 in double rows on each side; mid-ventral pedicels rarely present. Ventrolateral papillae 4–24 on each side. Dorsal papillae 4–36 on each side in single or double rows per dorsal ambulacrum. Papillae elongate and filiform, never stout or rudimentary. Spicules dorsally crosses and rods with dichotomously ramified ends and small rods with rudimentary ramifications; ventrally robust rods with enlarged spiny ends and large ellipsoidal to rounded bodies plus all intermediates between these two types.

Material examined

SAM–A23441, R.V. *Meiring Naude*, SM 72, 27°17,8′S 33°04,5′E, 20 May 1976, 1 050 m, beam trawl, 2 specimens. SAM–A23439, SM 74, 21 May 1976, 860 m, beam trawl, 6 specimens.

Description

SAM–A23439. Specimens flattened. Maximum length 60 mm. Colour white with yellowish tentacles and pale yellow tips to pedicels. Tentacles 19–20. Ventrolateral pedicels 14–20, in single rows (max. length 8 mm). Ventrolateral papillae approximately 4–10 on each side (max. length 12 mm). Dorsal papillae 2–10 in single rows per dorsal radius (max. length 10 mm).

Body wall thin, translucent. Dorsal deposits a few crosses and dichotomously ramified rods (0,27–0,88 mm), sturdier posteriorly but with spiny extremities (Figs 4A, 7A). Ventral deposits (0,81–1,08 mm), resembling those of *O. aspersignis* (Figs 4B–C, 7A).

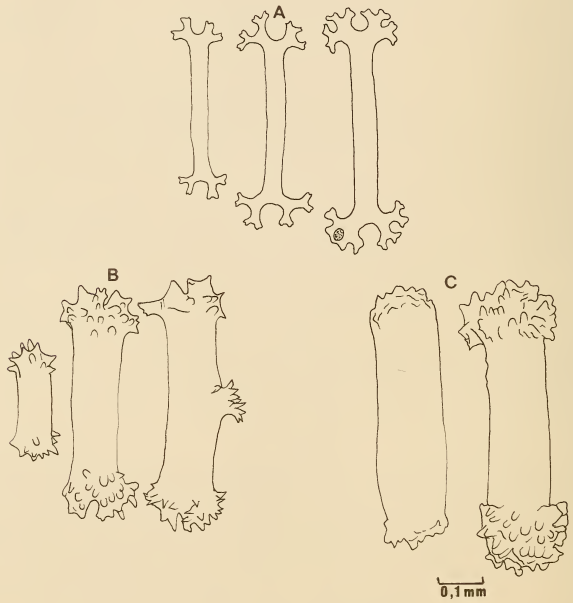

Fig. 4. *Orphnurgus insignis* Fisher. SAM–A23439. Body wall spicules. A. Rods from mid-dorsal body wall. B. Rods from anteroventral body wall. C. Rods from posteroventral body wall. All drawn to same scale.

SAM–A23441. Maximum length 70 mm, form subcylindrical. Tentacles 20 in one, 13 (?15) in the other. Ventrolateral pedicels 18–21 (max. length 8 mm). Ventrolateral papillae 7–10 (max. length 14 mm). Dorsal papillae 7–20 in single rows, one pair radius (max. length 16 mm). Spicules as above.

Remarks

In possessing only crosses and dichotomously ramified rods and their derivatives, the southern African material is identical to Fisher's (1907) species from Hawaii and Ohshima's (1915) from Japan. However, it shows some geographic variations, differing from the Hawaiian form in its smaller size and lower number of papillae, and from the Japanese form in having only one row of dorsal papillae on each side. Hence the diagnosis of the species is here modified to take in the new form. The aberrant Hawaiian specimens of Fisher were extraordinary in possessing mid-ventral pedicels not encountered elsewhere in the genus. Further, they have a higher number of ventrolateral pedicels in one or two rows and double rows of dorsal papillae.

As in *O. aspersignis* and in other species of the genus, there is no correlation between the size of the specimens and the number of tentacles. The largest individual (70 mm) has only 13 (?15) tentacles, whereas the majority (including the smallest) have 20. There is also no correlation between the size of the specimens and the number of pedicels, which varies from 15 to 21. Although the highest pedicel number (21 pairs) is found in the largest individual (70 mm), the two smallest individuals (48 mm) both have 20 pairs each. Perhaps, here again, the sample is too small (8 specimens) and the size range too narrow (48–70 mm) for any effective analysis.

As in *O. aspersignis*, the number of ventrolateral and dorsal papillae generally increases with the increase in size of the specimens. However, the smallest individual has a relatively high number of dorsal and ventrolateral papillae—9 and 10 pairs respectively. There is also a close correlation, in each specimen, between the number of ventrolateral and dorsal papillae, except in the largest specimen, which has twice as many dorsal as ventrolateral papillae.

In *O. insignis*, as in other species of the genus, the basic type of deposit is found in the dorsal body wall and sturdier deposits, in various stages of transformation, occur ventrally. As in *O. aspersignis* and other related species, the transformation does not affect the extremities of the deposits.

Orphnurgus insignis most closely resembles *O. glaber* from the Bay of Bengal, which has rods with few terminal ramifications and rather sturdy rods with enlarged spinous extremities. In *O. glaber* (s. s.), however, there are no ellipsoidal or dumbbell-shaped deposits. It is likely that the condition in *O. insignis* is a modification of that present in *O. glaber*.

Distribution

Off Natal, between Cape St Lucia and Kosi Bay, 860–1 050 m, south-east Africa, Japan, Hawaii, and Philippines.

Orphnurgus natalasper sp. nov.

Figs 5, 7B

Diagnosis

Tentacles 19. Ventrolateral pedicels about 40 on each side in alternating double or triple rows. Mid-ventral pedicels absent. Ventrolateral papillae about 20 on each side in a single row. Dorsal papillae about 43–44 in alternating double rows in each dorsal radius, decreasing to single rows posteriorly. Dorsal deposits very spinous, often perforated rods with spines frequently present throughout length of rod; ventral deposits sturdier rods with spiny ends and huge dumbbell-shaped deposits with spiny extremities.

Etymology

The specific name is derived from a combination of Natal, the type locality, and *asper* because of rods of the *O. asper* Théel type.

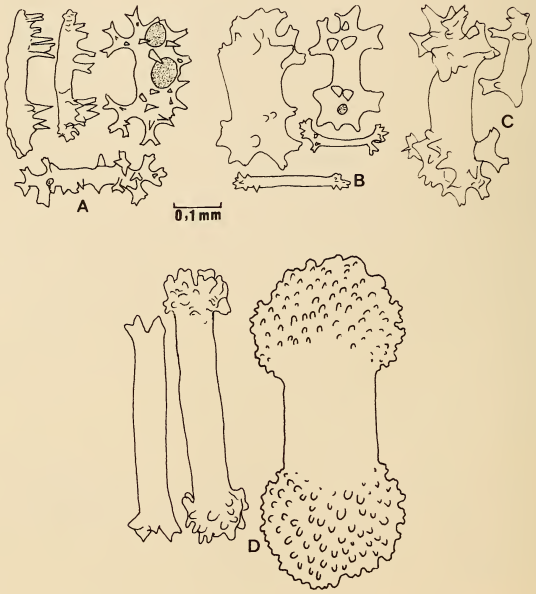

Fig. 5. *Orphnurgus natalasper* sp. nov. SAM–A23440. Holotype. Spicules. A. Rods from mid-dorsal body wall. B. Rods from anteroventral body wall. C. Rods from mid-ventral body wall. D. Rods from posteroventral body wall. All drawn to same scale.

Material examined

Holotype, SAM–A23440, off Lake St Lucia, Natal, R.V. *Meiring Naude*, SM 74, 27°38,6′S 32°52,6′E, beam trawl, 2 April 1976, 860 m.

Description

Length 82 mm, breath in mid-body 16 mm. Form subcylindrical. Tentacles 19, discs with extremely contracted ramifications giving the tentacles a distinctly peltate appearance. Ventrolateral pedicels short (max. length 10 mm), stout, about 40 on each side, arranged alternately in double or triple rows. Ventrolateral papillae about 20 on each side with some indication of a zigzag arrangement, size equal to that of pedicels. Dorsal papillae about 43–44 on each side in

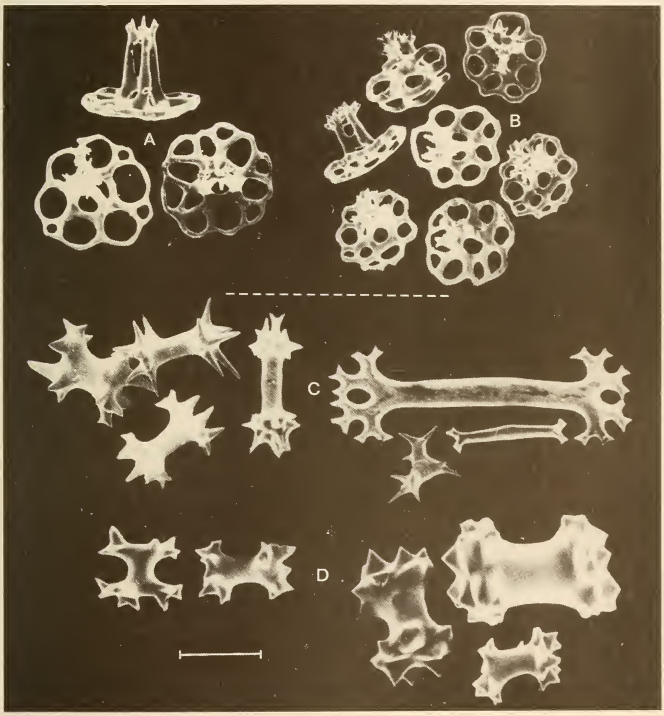

Fig. 6. SEM micrographs of body-wall spicules. A–B. *Mesothuria parva* (Théel). A. Large tables. B. Small tables. C–D. *Orphnurgus aspersignis* sp. nov. C. Dorsal body wall. D. Ventral body wall. Scale bars = 50 μm.

alternating double rows per ambulacrum, varying from short, rudimentary to long and filiform (max. length 10 mm). Anterior papillae with light yellow tips. Body wall relatively thick, opaque.

Spicules. Dorsally short spinous rods (0,14–0,30 mm long), spines long, usually undivided but occasionally bifid or even trifid at apex. Rods frequently

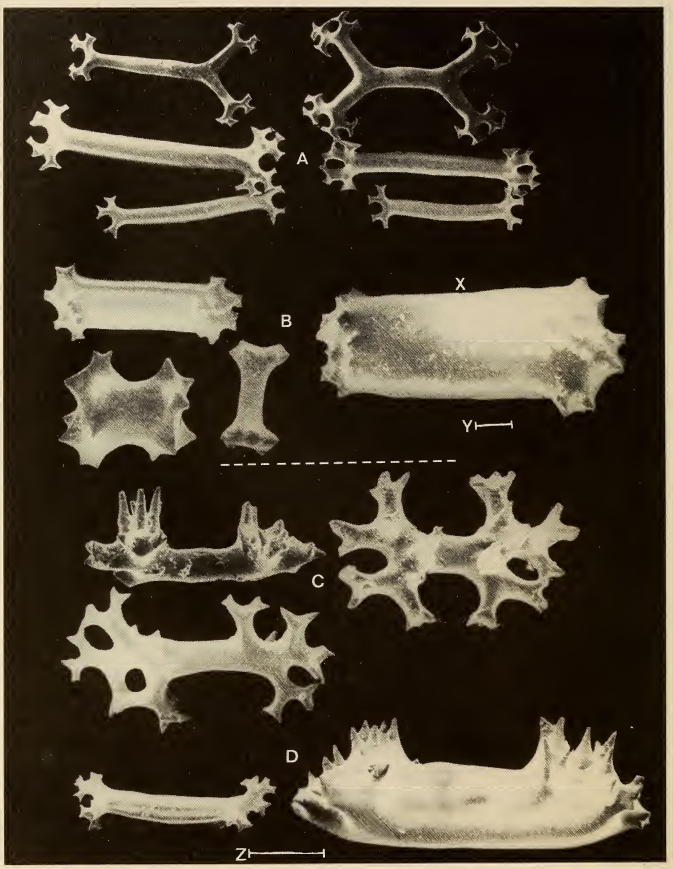

Fig. 7. SEM micrographs of body-wall spicules. A–B. *Orphnurgus insignis* Fisher. A. Dorsal body wall. B. Ventral body wall. C–D. *Orphnurgus natalasper* sp. nov. C. Dorsal body wall. D. Ventral body wall. (X—scale Y; others—scale Z). Scale bars = 50 μm.

perforated, the holes resulting from fusions of distal ends of some long spines (Figs 5A, 7B). Ventrally sturdier rods (Figs 5B–D) with few spiny projections, slender rods with spinous terminal ramifications, and huge elongate to dumbbell-shaped bodies, also with spinous extremities. Length of ventral spicules 0,22–0,58 mm. Spatulate rods, crosses, ellipsoidal and amorphous deposits absent. Pedicels with stout, elongate or tripartite rods with spinous extremities. Tentacular discs and papillae with slender rods (0,22–0,35 mm long) with spinous dichotomous ramifications.

Remarks

In the presence of double rows of ventrolateral pedicels and dorsal papillae and the occurrence of different form of spinous rods, this species is distinct from the other southern African species of the genus. Since double rows of pedicels and papillae do occur sporadically in members of a single species within the genus, it may be argued that *O. natalasper* is a variant of *O. aspersignis*. However, the nature of the spinous rods and the absence of any dichotomously ramified deposits support the taxonomic status of *O. natalasper*.

Whereas the spinous rods, with their frequent perforations, are reminiscent of those of *O. asper*, the ventral spicules are somewhat like those of *O. aspersignis*; hence *O. natalasper* appears intermediate between the two species. It differs from *O. asper* not only in the nature of the ventral deposits (no transformation of deposits occur in *O. asper*) but also in the high number of double-rowed pedicels and the low number of dorsal papillae. The similarity of the spinous rods in both species might suggest that *O. asper* probably developed from a form resembling *O. natalasper* in which there was a loss of transformation of the ventral deposits. It is possible that further intermediates, more closely approaching the *O. asper* condition, may occur in waters of the Eastern Atlantic Ocean.

Distribution

Known only from the holotype, off Lake St Lucia, Natal coast.

ACKNOWLEDGEMENTS

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6. SYSTEMATIC papers must conform to the *International code of zoological nomenclature* (particularly Articles 22 and 51).

Names of new taxa, combinations, synonyms, etc., when used for the first time, must be followed by the appropriate Latin (not English) abbreviation, e.g. gen. nov., sp. nov., comb. nov., syn. nov., etc.

An author's name when cited must follow the name of the taxon without intervening punctuation and not be abbreviated; if the year is added, a comma must separate author's name and year. The author's name (and date, if cited) must be placed in parentheses if a species or subspecies is transferred from its original genus. The name of a subsequent user of a scientific name must be separated from the scientific name by a colon.

Synonymy arrangement should be according to chronology of names, i.e. all published scientific names by which the species previously has been designated are listed in chronological order, with all references to that name following in chronological order, e.g.:

Family **Nuculanidae**

Nuculana (Lembulus) bicuspidata (Gould, 1845)

Figs 14–15A

Nucula (Leda) bicuspidata Gould, 1845: 37.
Leda plicifera A. Adams, 1856: 50.
Laeda bicuspidata Hanley, 1859: 118, pl. 228 (fig. 73). Sowerby, 1871: pl. 2 (fig. 8a–b).
Nucula largillierti Philippi, 1861: 87.
Leda bicuspidata: Nicklès, 1950: 163, fig. 301; 1955: 110. Barnard, 1964: 234, figs 8–9.

Note punctuation in the above example:
comma separates author's name and year
semicolon separates more than one reference by the same author
full stop separates references by different authors
figures of plates are enclosed in parentheses to distinguish them from text-figures
dash, not comma, separates consecutive numbers.

Synonymy arrangement according to chronology of bibliographic references, whereby the year is placed in front of each entry, and the synonym repeated in full for each entry, is not acceptable.

In describing new species, one specimen must be designated as the holotype; other specimens mentioned in the original description are to be designated paratypes; additional material not regarded as paratypes should be listed separately. The complete data (registration number, depository, description of specimen, locality, collector, date) of the holotype and paratypes must be recorded, e.g.:

Holotype

SAM–A13535 in the South African Museum, Cape Town. Adult female from mid-tide region, King's Beach, Port Elizabeth (33°51'S 25°39'E), collected by A. Smith, 15 January 1973.

Note standard form of writing South African Museum registration numbers and date.

7. SPECIAL HOUSE RULES

Capital initial letters

(a) The Figures, Maps and Tables of the paper when referred to in the text
e.g. '. . . the Figure depicting *C. namacolus* . . .': '. . . in *C. namacolus* (Fig. 10) . . .'
(b) The prefixes of prefixed surnames in all languages, when used in the text, if not preceded by initials or full names
e.g. Du Toit but A. L. du Toit; Von Huene but F. von Huene
(c) Scientific names, but not their vernacular derivatives
e.g.Therocephalia, but therocephalian

Punctuation should be loose, omitting all not strictly necessary

Reference to the author should preferably be expressed in the third person

Roman numerals should be converted to arabic, except when forming part of the title of a book or article, such as
'Revision of the Crustacea. Part VIII. The Amphipoda.'

Specific name must not stand alone, but be preceded by the generic name or its abbreviation to initial capital letter, provided the same generic name is used consecutively. The generic name should not be abbreviated at the beginning of a sentence or paragraph.

Name of new genus or species is not to be included in the title; it should be included in the abstract, counter to Recommendation 23 of the Code, to meet the requirements of Biological Abstracts.

AHMED S. THANDAR

THE SOUTH AFRICAN MUSEUM'S *MEIRING NAUDE* CRUISES. PART 18. HOLOTHUROIDEA